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Part 5: Smart home device specification

Technologies de l'information — Spécification de la Fondation pour la connectivité ouverte (Fondation OCF) —

Partie 5: Spécification des appareils pour applications domotiques

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted (see www.iso.org/directives).

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This document was prepared by the Open Connectivity Foundation (OCF) (as the OCF Smart Home Device Specification, Version 1.0.0) and drafted in accordance with its editorial rules. It was adopted, under the JTC 1 PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

A list of all parts in the ISO/IEC 30118 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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1 Scope

The OCF Smart Home Device specification is an Application Profile specification.

The Smart Home Device specification specifies the Smart Home devices. The Smart Home Device definitions use Resource definitions from the OCF Resource Type Specification.

The Smart Home Device Specification is built on top of the Core Specification. The Core Specification specifies the core architecture, interfaces protocols and services to enable the implementation of profiles for IoT usages and ecosystems. The Core specification also defines the main architectural components of network connectivity, discovery, data transmission, device & service management and ID & security. The core architecture is scalable to support simple devices (constrained devices) and more capable devices (smart devices).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

OCF Core Specification, *Open Connectivity Foundation Core Specification*, Version 1.0.

OCF Resource Type Specification, *Open Connectivity Foundation Resource Type Specification*, Version 1.0.

OCF Security Specification, *Open Connectivity Foundation Security Capabilities*, Version 1.0

IETF RFC 7049, *Concise Binary Object Representation (CBOR)*, October 2013
http://www.ietf.org/rfc/rfc7049.txt

IETF RFC 7159, *The JavaScript Object Notation (JSON) Data Interchange Format*, March 2014
http://www.ietf.org/rfc/rfc7159.txt

RAML, *Restful API modelling language*, Version 0.8.
https://github.com/raml-org/raml-spec/blob/master/versions/raml-08/raml-08.md

IETF RFC 4566, SDP: Session Description Protocol, July 2006
https://tools.ietf.org/html/rfc4566

3 Terms, definitions symbols and abbreviations

3.1 Terms and definitions

3.1.1
Actuator
Resource with support of the UPDATE operation.

3.1.2
Smart Home Bridge Device
A Smart Home Device that is capable of representing other devices that exist on the network.

3.1.3
Smart Home Device
A Device that is conformant to the normative requirements contained in this specification.

3.1.4
Sensor
Resource without support of the UPDATE operation.

3.2 Symbols and abbreviations

3.2.1
CRUDN
Create Retrieve Update Delete Notify
This is an acronym indicating which operations are possible on the Resource.

3.2.2
CSV
Comma Separated Value
Comma Separated Value is a construction to have more fields in 1 string separated by commas. If a value itself contains a comma then the comma can be escaped by adding "\" in front of the comma.

3.2.3

OCF
Open Connectivity Foundation
The organization that created these specifications.

3.2.4
RAML
RESTful API Modelling Language
RAML is a simple and succinct way of describing practically-RESTful APIs. See RAML.

3.2.5
REST
Representational State Transfer
REST is an architecture style for designing networked applications and relies on a stateless, client-server, cacheable communications protocol.

3.2.6
SDP
Session Description Protocol
SDP describes multimedia sessions for the purposes of session announcement, session invitation, and other forms of multimedia session initiation. It is fully defined in https://github.com/raml-org/raml-spec/blob/master/versions/raml-08/raml-08.md
IETF RFC 4566.

3.3 Conventions

In this specification a number of terms, conditions, mechanisms, sequences, parameters, events, states, or similar terms are printed with the first letter of each word in uppercase and the rest lowercase (e.g., Network Architecture). Any lowercase uses of these words have the normal technical English meaning.

4 Document conventions and organization

This document lists all the Devices used in the smart home domain. The devices are specified by which mandatory and optional Resources are used.

For the purposes of this document, the terms and definitions given in OCF Core Specification and OCF Resource Type Specification apply.

4.1 Notation

In this document, features are described as required, recommended, allowed or DEPRECATED as follows:

Required (or shall or mandatory).

These basic features shall be implemented to comply with a Smart Home Device. The phrases “shall not”, and “PROHIBITED” indicate behavior that is prohibited, i.e. that if performed means the implementation is not in compliance.

Recommended (or should).

These features add functionality supported by a Smart Home Device and should be implemented. Recommended features take advantage of the capabilities a Smart Home Device, usually without imposing major increase of complexity. Notice that for compliance testing, if a recommended feature is implemented, it shall meet the specified requirements to be in compliance with these guidelines. Some recommended features could become requirements in the future. The phrase “should not” indicates behavior that is permitted but not recommended.

Allowed (or allowed).

These features are neither required nor recommended by a Smart Home Device, but if the feature is implemented, it shall meet the specified requirements to be in compliance with these guidelines.

Conditionally allowed (CA).

The definition or behaviour depends on a condition. If the specified condition is met, then the definition or behaviour is allowed, otherwise it is not allowed.

Conditionally required (CR).

The definition or behaviour depends on a condition. If the specified condition is met, then the definition or behaviour is required. Otherwise the definition or behaviour is allowed as default unless specifically defined as not allowed.

DEPRECATED

Although these features are still described in this specification, they should not be implemented except for backward compatibility. The occurrence of a deprecated feature during operation of an implementation compliant with the current specification has no effect on the implementation’s operation and does not produce any error conditions. Backward compatibility may require that a feature is implemented and functions as specified but it shall never be used by implementations compliant with this specification.

Strings that are to be taken literally are enclosed in “double quotes”.

Words that are emphasized are printed in *italic*.

4.2 Data types

See OCF Core Specification.

4.3 Document structure

The Smart Home Device specification defines a Device for usage in the Smart Home vertical. This document describes a Device and makes use of functionality defined in the OCF Core Specification and OCF Resource Type Specification.

The OCF Core Specification provides building blocks to define Devices. The following functionality is used:

- Required Core Resources.
- Required transports.

Note that other mandatory functions in the OCF Core Specification might be needed to create an OCF compliant device, but are not mentioned in this document.

The Smart Home Device profile consists of using RAML as a specification language and using JSON Schemas as payload definitions for all CRUDN actions. The mapping of the CRUDN actions is specified in the CORE.

Other building blocks used in this document are the Resource Types specified in the OCF Resource Type Specification.

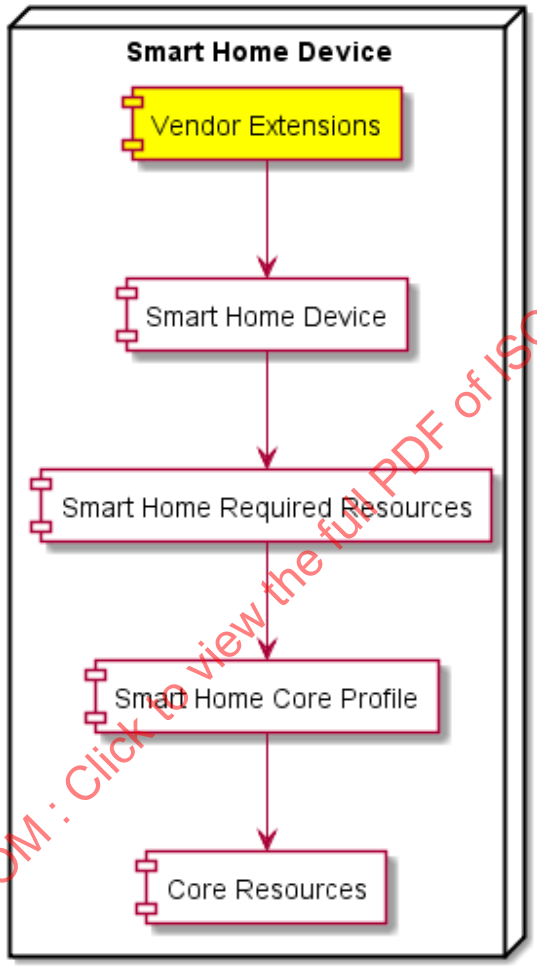

Figure 1 Smart Home device building blocks.

This document describes which constructs are used for a Smart Home Device and which Resources are mandated to be implemented for each Smart Home Device. A typical Smart Home Device consisting of data elements defined in the referenced specification documents is depicted in Figure 1.

5 Operational Scenarios

5.1 Specification Version

Devices conformant to this specification version shall add the string “ocf.sh.1.0.0” to the dmv Property in oic.wk.d.

6 Core Resource model

6.1 Introduction

The Core Resource model is described in the OCF Core Specification.

6.2 Device Type

The device types of all Smart Home devices shall have a Resource Type name ("rt") prefixed with "oic.d."

Examples of Device Types are:

- oic.d.fan
- oic.d.thermostat

The full list of Smart Home defined Device names and types are in Table 9-1. This table also includes the list of minimal Resource(s) that a Device shall implement for that device type. A device may expose additional OCF and vendor defined Resources than indicated in this Table.

The OCF Core Specification defines a Device Resource with a URI of "/oic/d". A Smart Home Device shall include in the Resource Type ID of "/oic/d" the device type from Table 9-1 of the physical device hosting the Server; the inclusion of the device type shall be done using one of the methods provided by Section 11.3.4 of the OCF Core Specification (i.e. add to the array of values). An instance of "/oic/d" with its Resource Type name modified in this manner shall expose all mandatory Properties for "/oic/d" defined in the OCF Core Specification.

Therefore a Smart Home Device may be discovered by adding a query for the "rt" of the Device Type itself (e.g. oic.d.fan) to the OCF Core Specification defined multicast endpoint discovery method (see also Section 7.1).

A Smart Home Device may additionally define a Resource with a vendor defined URI that is discoverable within "/oic/res" with a Resource Type ID from Table 9-1. In this instance the Resource shall have the Resource Properties and be subject to the same semantics as oic.wk.d as defined in the OCF Core Specification. In the case where the Resource tagged in this manner additionally follows the Collection semantics defined in the OCF Core Specification then the Resources that are part of that Collection shall at a minimum include the Resources defined for the Resource Type ID in Table 9-1.

6.3 Profile of OCF Core Specification

This section describes the profiling of the Core Resources and transport mechanisms and functions that are defined in the OCF Core Specification.

The required OCF Core Specification Resources are also required for a Smart Home profile implementation.

In addition to the required Resources the optional OCF Core Specification Resources in Table 6-1 shall be required for a Smart Home Profile.

Table 6-1 Required Resources for Smart Home Devices

Resource ("rt")	Required in Profile
Intentionally left blank	Intentionally left blank

For each of the Resources listed in Table 6-1 Required Resources for Smart Home Devices, Table 6-2 Required Properties in Resource details the Properties within those Resources that shall be required for a Smart Home Profile.

Table 6-2 Required Properties in Resource

Resource (“rt”)	Property name	Required in Profile
Intentionally left blank	Intentionally left blank	Intentionally left blank

A Smart Home Device shall support CoAP based endpoint discovery as defined in Section 10.2 of the OCF Core Specification.

The messaging protocol for a Smart Home Device shall be CoAP (see OCF Core Specification).

A Smart Home Device shall support a network layer as defined in Section 9 of the OCF Core Specification including any necessary defined bridging functions that ensure inter-operability with IPv6.

7 Discovery

7.1 Endpoint Discovery

Clients may discover Servers by using the mechanisms defined by the OCF Core Specification Section 10. A Client may populate an “rt” query parameter with the Device Types that the Client wants to discover, or if no “rt” query parameter is provided then the search is for all available Device Types irrespective.

Smart Home Devices may be discovered by Device Type or implemented Resource Type. This difference is conveyed by the wanted “rt” argument of the OCF Core Specification discovery method (see section 11.3 of the OCF Core Specification).

The values that may be used for discovering a specific Device Type are listed in Table 9-1 . The values that may be used to discover a specific Resource Type are listed in the OCF Resource Type Specification in section 6.

The discovery process provides the base URI of the Device that is acting as a Server to the Client. The structure of the detected Device can then be retrieved by Resource Discovery.

7.2 Resource Discovery

Section intentionally left blank

8 Security

A Smart Home Device shall implement the mandated security Resources specified in the OCF Security Specification. Additionally, it is recommended that exposed Resources as defined by the OCF Resource Type Specification be accessible only via encrypted channels following completion of the onboarding process as defined in the OCF Security Specification; it is not recommended to allow access via unencrypted channels.

9 Device Types

9.1 Standardized device types

Device Types can mandate that specific Resources be implemented. The required Resource per Device Type is listed in Table 9-1. Additionally, specific Resources that use enumeration values

to indicate supported states or modes may mandate usage of standardized enumeration values. The mandated allowed values are indicated for each applicable Resource Type, the Property of interest on that Resource Type and to which device type it applies.

Per Table 9-1, some Smart Home Device types support two instances of the same Resource Type. When this is the case, the Resources shall support different CRUDN actions, e.g. one Resource acts as a Sensor (CRUDN action write not supported) and the other Resource acts as an Actuator (CRUDN actions read and write supported at a minimum) unless otherwise specified.

Table 9-1 Alphabetical list of device types ("rt"), including required Resources.

Device Name (informative)	Device Type ("rt") (Normative)	Required Resource name	Required Resource Type
Air Conditioner	oic.d.airconditioner	Binary Switch	oic.r.switch.binary
		Temperature	oic.r.temperature
Air Purifier	oic.d.airpurifier	Binary Switch	oic.r.switch.binary
Air Quality Monitor	oic.d.airqualitymonitor	Air Quality Collection	oic.r.airqualitycollection
Blind	oic.d.blind	Open Level	oic.r.openlevel
Camera	oic.d.camera	Media	oic.r.media
Clothes Washer Dryer	oic.d.washerdryer	Binary Switch	oic.r.switch.binary
		Operational State	oic.r.operational.state
Cooker Hood	oic.d.cookerhood	Airflow Control	oic.r.airflowcontrol
		Binary Switch	oic.r.switch.binary
		Mode	oic.r.mode
Cooktop	oic.d.cooktop	Heating Zone Collection	oic.r.heatingzonecollection
Dehumidifier	oic.d.dehumidifier	Binary Switch	oic.r.switch.binary
		Humidity	oic.r.humidity

Dishwasher	oic.d.dishwasher	Binary Switch	oic.r.switch.binary
		Mode	oic.r.mode
Door	oic.d.door	Open Level	oic.r.openlevel
Dryer (Laundry)	oic.d.dryer	Binary switch	oic.r.switch.binary
		Mode	oic.r.mode
Fan	oic.d.fan	Binary Switch	oic.r.switch.binary
Food Probe	oic.d.foodprobe	Temperature (Sensor)	oic.r.temperature
Freezer	oic.d.freezer	Temperature(2)(1 Sensor and 1 Actuator)	oic.r.temperature
Garage Door	oic.d.garagedoor	Door	oic.r.door
Generic Sensor	oic.d.sensor	Any Resource Type that supports and exposes in "/oic/res" the oic.if.s interface.	oic.r. <x> Where this equates to any Resource Type that supports the oic.if.s Interface.
Humidifier	oic.d.humidifier	Binary Switch	oic.r.switch.binary
Light	oic.d.light	Binary Switch	oic.r.switch.binary
Oven	oic.d.oven	Binary Switch	oic.r.switch.binary
		Temperature (2) (1 Sensor and 1 Actuator)	oic.r.temperature
Printer	oic.d.printer	Binary Switch	oic.r.switch.binary
		Operational State	oic.r.operational.state
	oic.d.multifunctionprinter	Binary switch	oic.r.switch.binary

Printer Multi-Function		Operational State (2)[1]	oic.r.operational.state
		Automatic Document Feeder	oic.r.automaticdocumentfeeder[2]
Receiver	oic.d.receiver	Binary Switch	oic.r.switch.binary
		Audio Controls	oic.r.audio
		Media Source List (2)	oic.r.media.input, oic.r.media.output
Refrigerator	oic.d.refrigerator	Temperature (2) (1 Sensor and 1 Actuator)	oic.r.temperature
Robot Cleaner	oic.d.robotcleaner	Binary Switch	oic.r.switch.binary
		Mode	oic.r.mode
Scanner	oic.d.scanner	Binary Switch	oic.r.switch.binary
		Operational State	oic.r.operational.state
		Automatic Document Feeder	oic.r.automaticdocumentfeeder
Security Panel	oic.d.securitypanel	Mode	oic.r.mode
Set Top Box	oic.d.stb	Binary Switch	oic.r.switch.binary
Smart Lock	oic.d.smartlock	Lock Status	oic.r.lock.status
Smart Plug	oic.d.smartplug	Binary Switch	oic.r.switch.binary
Switch	oic.d.switch	Binary Switch	oic.r.switch.binary
Television	oic.d.tv	Binary Switch	oic.r.switch.binary

[1] A Multi-Function Printer shall expose two instances of an Operational State resource; each in discrete Collections, one for the Printer specific operational state information and one for the Scanner specific operational state information. The friendly name for the Collections should indicate the device modality (printer or scanner).

[2] A Multi-Function Printer shall only expose an Automatic Document Feeder resource if the device has the Automatic Document Feeder capability.

		Audio Controls	oic.r.audio
		Media Source List	oic.r.media.input
Thermostat	oic.d.thermostat	Temperature (2) (1 Sensor and 1 Actuator)	oic.r.temperature
Washer (Laundry)	oic.d.washer	Binary Switch	oic.r.switch.binary
		Operational State	oic.r.operational.state
Water Valve	oic.d.watervalve	Open Level	oic.r.openlevel

9.2 Standardized enumeration values

Resource Types may have a list of supported enumeration values. The supported enumeration values may differ when applied in different devices. In this section the affected Resource Types are described by:

- Generic list of supported values
- Mandated list of supported values when applied to a specific Device

9.3 Alphabetical list of standardized enumeration types

This section lists the standardized enumeration types that are used in the oic.r.mode, oic.r.operational.state, and oic.r.consumable Resources.

- aborted
  - An internal device, communication or security error
- active
  - Unit is active
- airDry
  - unit is air drying
- armedAway
  - unit is armed for away
- armedInstant
  - unit is armed instantly
- armedMaximum
  - unit is armed at maximum level
- armedNightStay

- unit is armed in night stay

- armedStay
  - unit is armed in stay mode
- cancelled
  - the job was cancelled either by the remote client or by the user
- completed
  - job finished successfully
- down
  - unit is unavailable
- dry
  - unit is dry mode
- disabled
  - unit's current operational mode is disabled
- enabled
  - unit's current operational mode is enabled
- filterMaterial
  - filter material that is used by a device
- idle
  - new jobs can start processing without waiting
- ink
  - generic ink cartridge for a device
- inkBlack
  - black ink cartridge for a device
- inkCyan
  - cyan ink cartridge for a device
- inkMagenta
  - magenta ink cartridge for a device
- inkTricolour
  - tricolour ink cartridge for a device
- inkYellow

- yellow ink cartridge for a device

- notsupported
  - ability to set a specific operational mode by a client is not supported
- pause
  - unit is paused (by user)
- pending
  - job initiated, engine is preparing
- pendingHeld
  - job is not a candidate for processing for any number of reasons, will return to pending state if reasons are solved.
- preWash
  - unit is pre wash mode
- processing
  - processing the job
- rinse
  - unit is rinse mode
- stopped
  - error condition occurred
- spin
  - unit is in spin mode
- testing
  - calibrating, preparing the unit
- toner
  - generic toner cartridge for a device
- tonerBlack
  - black toner cartridge for a device
- tonerCyan
  - cyan toner cartridge for a device
- tonerMagenta
  - magenta toner cartridge for a device

- tonerYellow
    - yellow toner cartridge for a device
- wash
    - unit is in wash mode
- wrinklePrevent
    - unit is in winkle prevent mode

9.4 Standardized list of supported values for Mode Resource Type (oic.r.mode)

The following enumeration values apply to both the supportedModes and modes Properties within the Mode Resource Type.

Table 9-2 list of required oic.r.mode supported values per device type ("rt")

Device Name (informative)	Device Type (rt) (Normative)	Required enumeration value
Security Panel	oic.d.securityPanel	active
		armedAway
		armedInstant
		armedMaximum
		armedNightStay
		armedStay

The modes can be viewed upon as mode changes of the device. However this specification does not impose any relationship between the different modes of a Device. Hence all mode changes are expected to occur from a Client point of view.

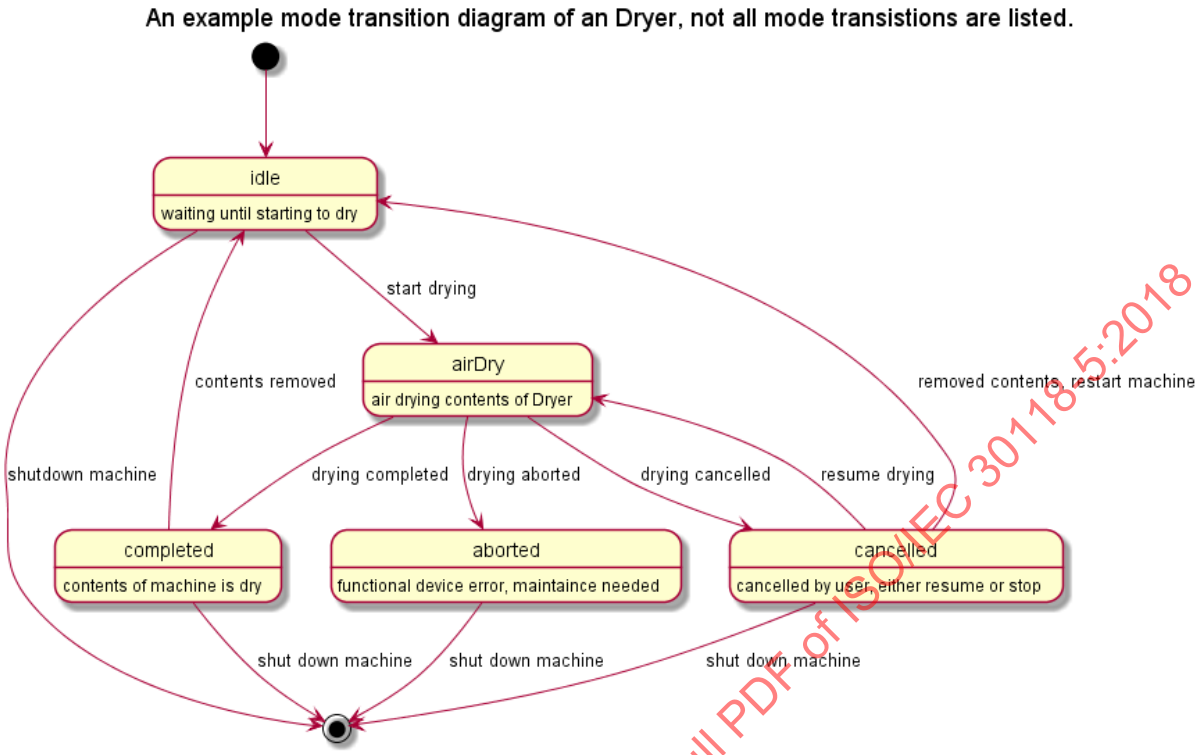

Figure 2 Example of mode transitions of a Dryer.

9.5 Standardized list of supported values for Operational State Resource Type (oic.r.operational.state)

The following enumeration values apply to the jobStates and machineStates Properties within the operational state Resource Type.

Table 9-3 list of required oic.r.operational.state supported values per Device Type ("rt")

Device Name (informative)	Device Type (rt) (Normative)	Required enumeration value machineStates	Required enumeration value jobStates
Printer	oic.d.printer	idle	pending
		processing	pendingHeld
		stopped	processing
			cancelled
			aborted
			completed